

Malta Amateur Radio League

Introduction to

Amateur Television



Compiled and Presented by

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What exactly is ATV?

- *Amateur Television* is the transmission of either *Slow Scan* pictures (SSTV) or *Fast Scan* pictures (FSTV).
- *Scan* meaning the “*drawing*” of the picture on the screen.



SSTV

- *Slow Scan* is normally used on the narrow bandwidths of *HF* and *VHF*.
- Usually *SSB* and *FM*.
- The *pictures are converted into audio* and sent *one at a time*.
- Each *frame* takes about *3 mins* to be sent!
- Very *noisy* and *unreliable*.
- Nowadays sent / received using a PC
- MIR Space Station used to Transmit SSTV!



FSTV

- *FSTV* is generally termed *ATV*.
- *25 frames per second* can be sent (Live Video).
- *Audio* channels can be used as *sub-carriers*.
- Same as broadcast TV standard (PAL B).
- Mode is *Wide Band FM*.
- Used on *Microwave* bands:
1.2GHz , 2.4GHz , 5.7GHz , 10GHz , 24GHz
- *Normally Analog* but Digital (DVB-S) transmitters are available.



Who uses ? & Why ATV ?

- ATV is one of the for-fronts in amateur radio technology.
- It is used in contests, DX-Peditions, Ham-Fairs ect
- There is an fortnightly ATV “magazine” transmitted from Sweden via the commercial broadcast satellite Sirius. This is receivable with a digital satellite TV System. Just turn the dish to the Sirius satellite and set the right frequency!!

Who uses ? & Why ATV ?

- With the help of 9H1ATV local field days and other events can be broadcast live, also construction projects and lectures can be given “on the air”
- Unfortunately an amateur satellite with an ATV repeater payload is not yet in orbit, however there are plans of having one as Phase 4 (Geo-stationary).
- Many Sicilians are active on ATV which will surely be of advantage to local 9H stations!

9H1LO – JM75EW



ATV via Ragusa ATV repeater



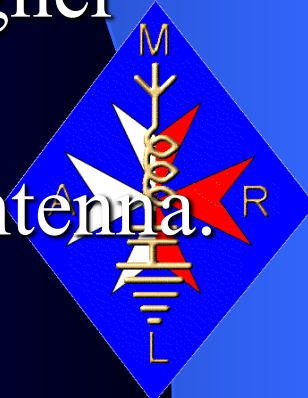
9TWC - IT9TWC - IT9TWC - IT9



ATV Transmitters / Receivers

Transmitters / Antennas

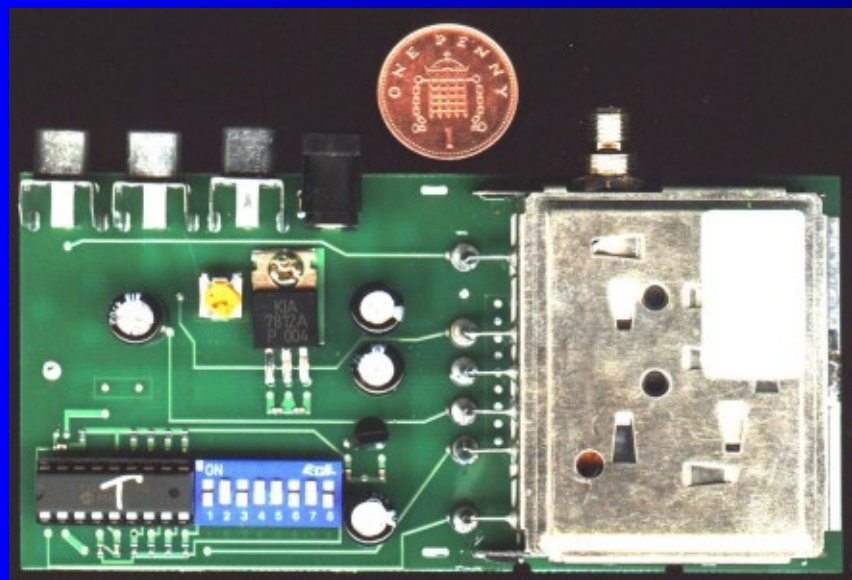
- *Can be built.*
 - Can be *purchased from G1MFG* (1.2GHz 65mW Transmitter about Lm30.00)
 - TVRO *LNBs can be modified* into 100mW 10GHz transmitters.
 - *Normal antennas* for the given band can be used however consideration must be taken for higher bandwidths
- Yagi, Dipole, Dish, Horn, or any suitable antenna.**



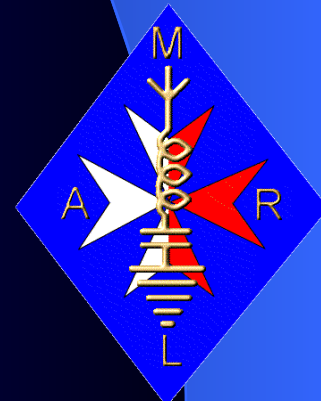
ATV Transmitters



Homebrew 10GHz ATV Transmitter
with Audio/Video modulator.
65mW Output.

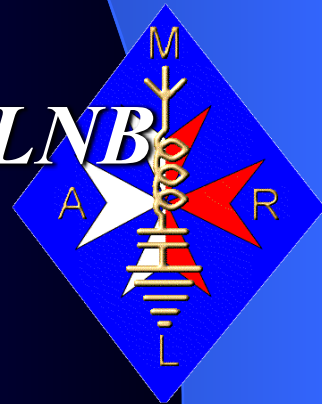


1.2GHz ATV Transmitter from
G1MFG.



Receivers

- *Amateur receivers* available for 1.2GHz and 2.4GHz from G1MFG.
- Surplus *domestic analogue TVRO* Receivers can be used for 1.2GHz and also 10GHz using a normal LNB.
- For 1.2GHz a *pre-amplifier* might be needed.
- The same as in the transmitter applies for antennas.
- Reception at 10GHz would normally be an *LNB* mounted on a small *Dish* or a *Horn*.



Receivers



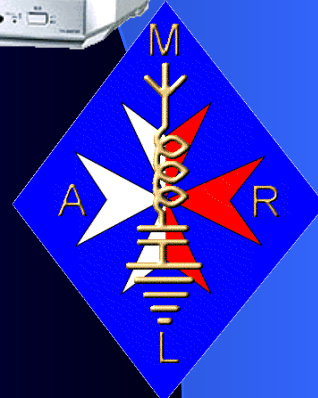
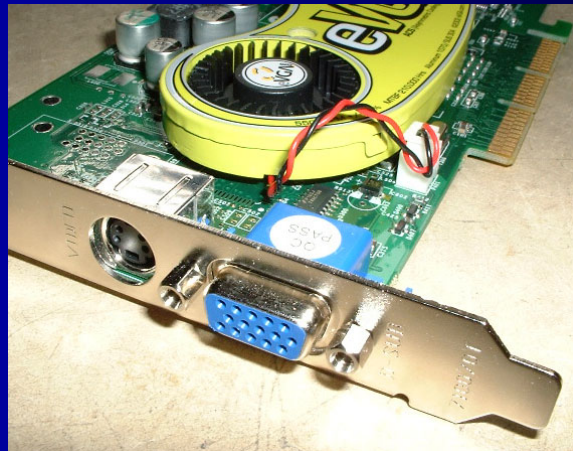
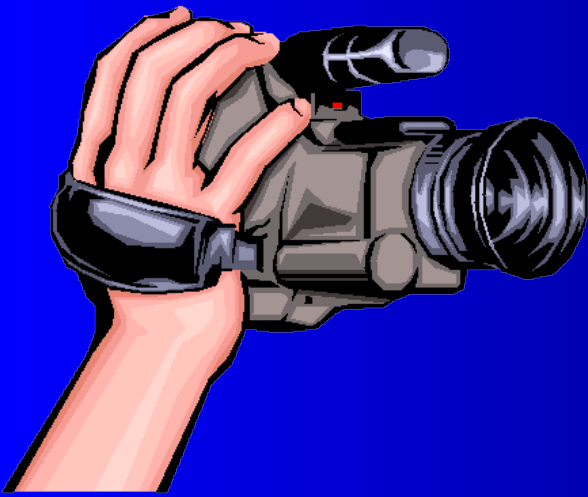
1.2GHz Receivers from G1MFG. They can also be used for 10GHz with A cheap satellite TV LNB.



Receive setup using a domestic receiver. (set-top box)

Other Equipment

- Video Camera
- Computer with video out
- Test Card Generator
- PAL TV / Monitor



9H1ATV

A microwave amateur television repeater



The Idea Behind 9H1ATV

- The idea of having a local ATV repeater is to encourage and educate interested amateurs to equip themselves to operate this mode.
- It will also help to increase the distance of contacts, and will also serve as the mid-med ATV hub, when eventually it will be linked to the ever expanding ATV repeater network in Sicily.
- It will provide easy setup access, I.E. stations will only need a minimum amount of equipment and power to access the repeater.
- It will provide interesting contacts especially from /M & /P stations!!



The Repeater



1.2GHz Antenna

1.2 GHz Receiver

Audio

Video

TX & Controller

10GHz Slotted Waveguide



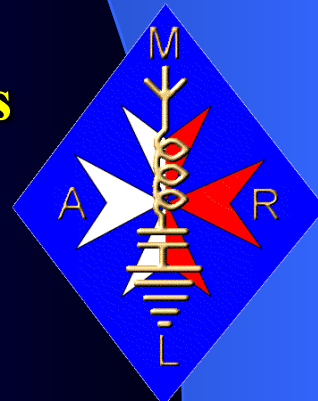
9H1ATV - Facts

- **9H1ATV was designed and built by 9H1LO**
- **The 1.2 GHz receive antennas was built by 9H1ES**
- **The 10GHz transmit antenna was built by 9H1PF**
- **It was installed in Mdina in March 2004 by 9H1LO & 9H1ES**

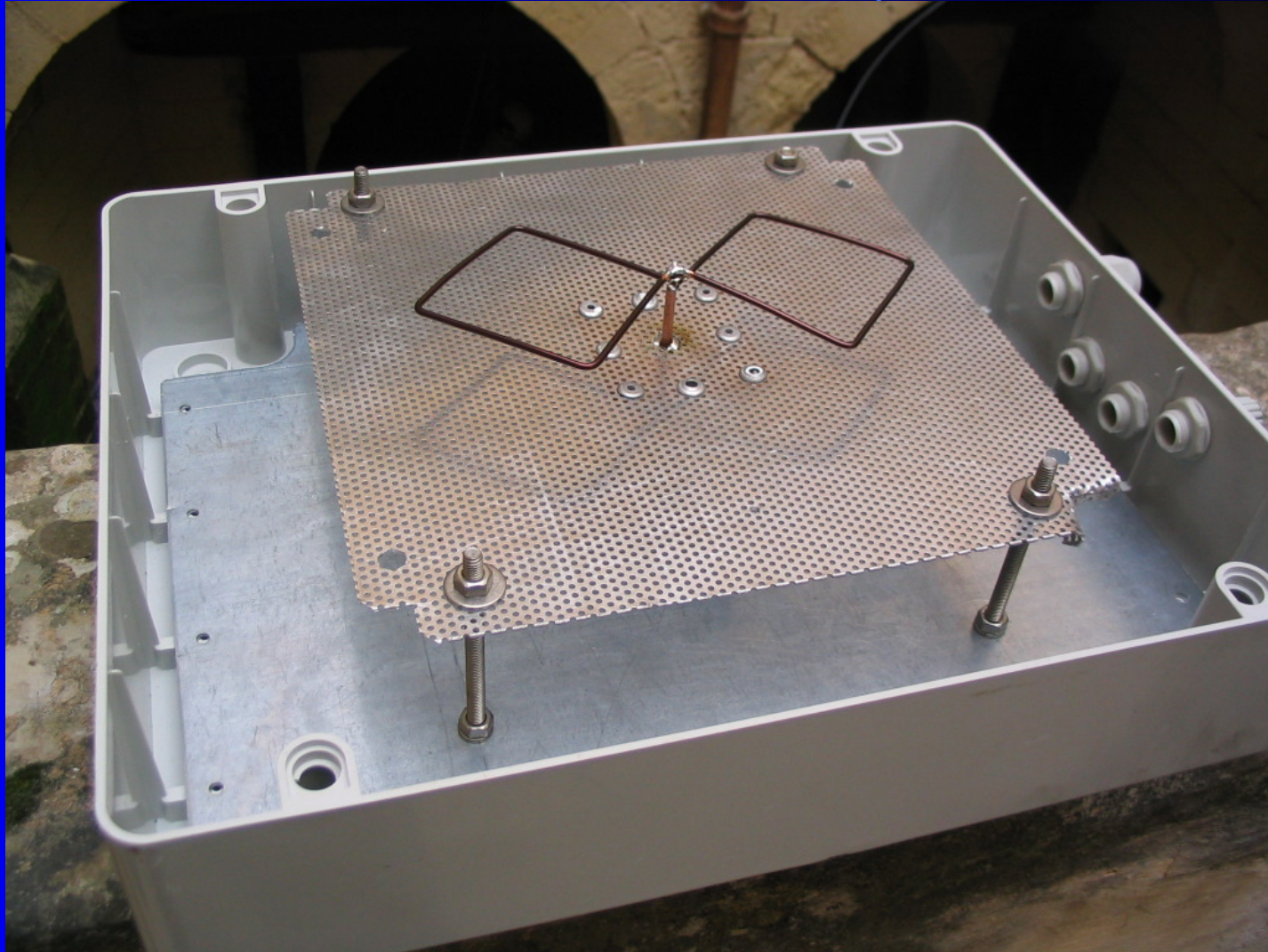


9H1ATV - Facts

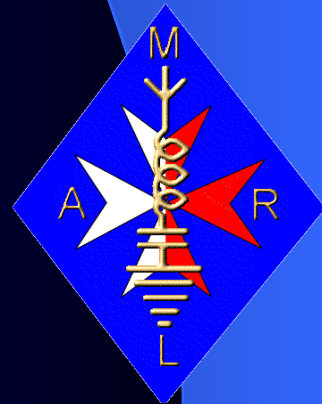
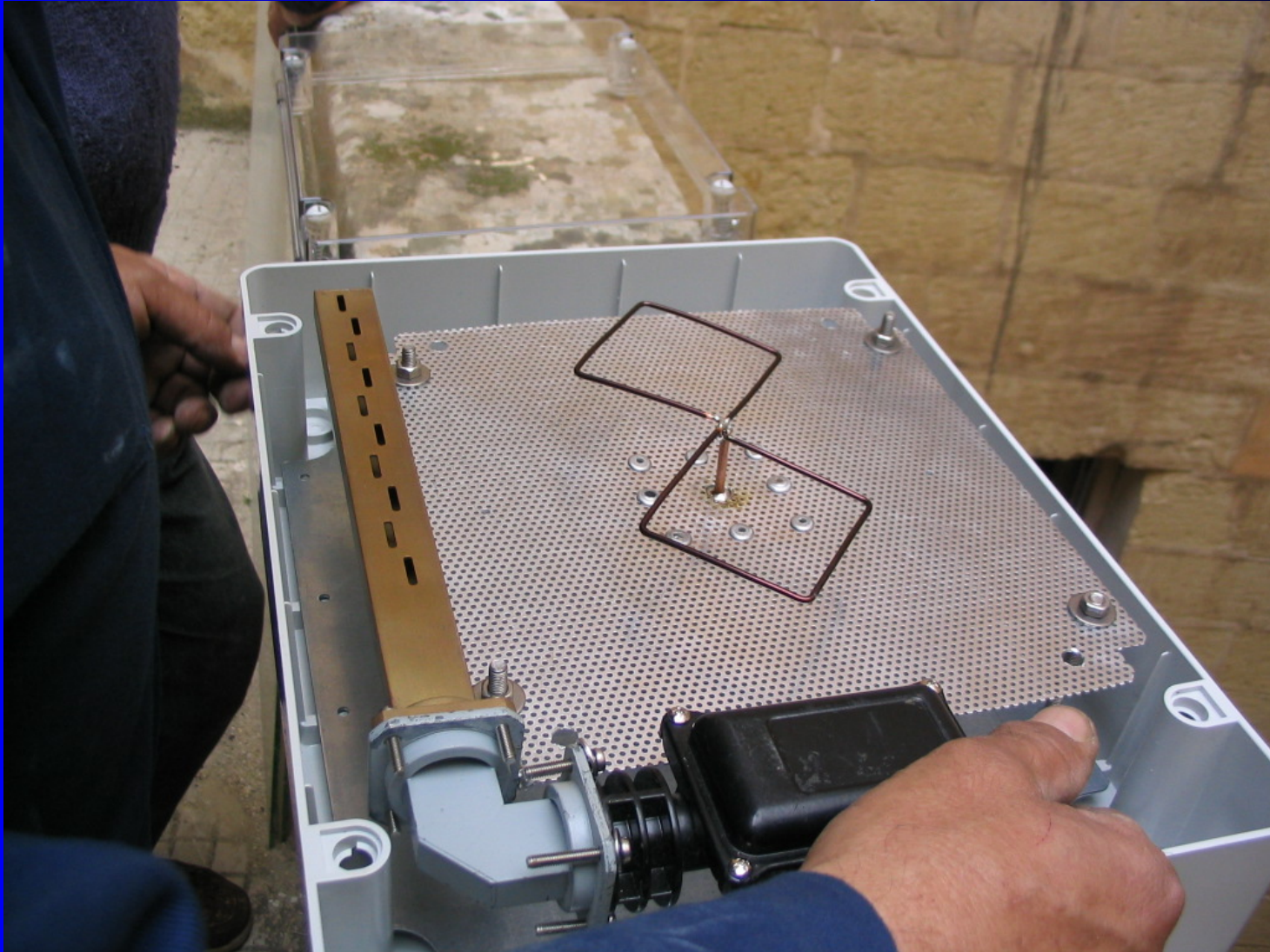
- Funding was from MARL, 9H1LO and 9H1ES
- It transmits a test card when no signal is received
- Output frequency is 10.475GHz
- Input frequency is 1255MHz
- It will switch to the received signal upon detecting VIDEO and not just a carrier
- If video ceases it will return to the test card after 8seconds



9H1ATV 1.2 GHz Receive antenna

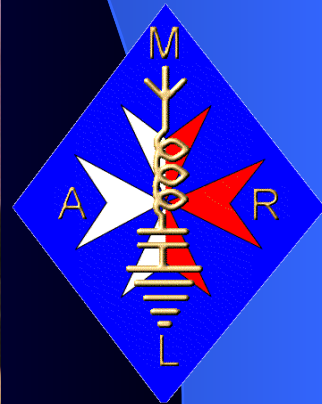


Transmit & Receive Antennas



9H1LO & 9H1ES

Just after switching 9H1ATV on the Air





9H1ES installing the 9H1ATV antennas at Mdina

Receiving 9H1ATV

- **Stations will need to have the ability to receive an analog video/audio signal at 10.475GHz**
- **This is done with an analog satellite receiver and a modified LNB**
- **Antenna should be a horn or preferably a dish**

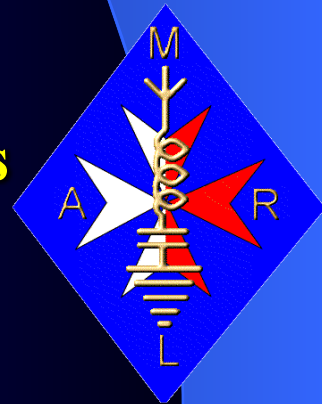


The 9H1ATV test card



Analog Satellite Receivers

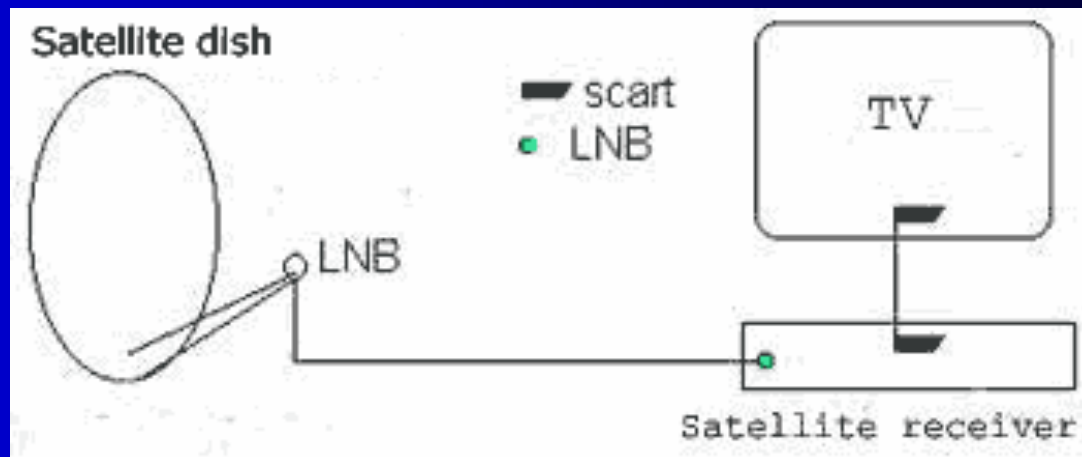
- These are the old type of TVRO receivers
- Frequency range is normally 900MHz – 2000MHz
- They are to be used as an IF with an LNB
- They normally have a SCART or Phono output that connects to your TV or monitor
- PC Card tuners can be used but not advisable as they are slow when it comes to synchronizing
- CRT monitors or TV's are better than TFT monitors as TFT's are slow at synchronizing and difficult to find a weak signal



Receiver

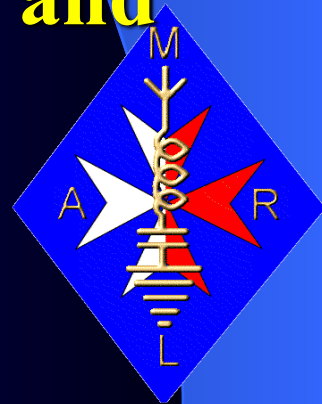


Coverage is 900MHz – 2000MHz so an LNB (down converter) must be used to convert 10GHz to about 1GHz



LNB (Low Noise Block)

- The LNB is a down converter from about 10.7GHz - 12GHz to 900MHz – 2GHz
- They have a built in horn and transition that is mounted on the dish to receive the signal from the satellite
- They have 2 Local Oscillators: 9.75GHz and 10.6GHz



Mathematics!

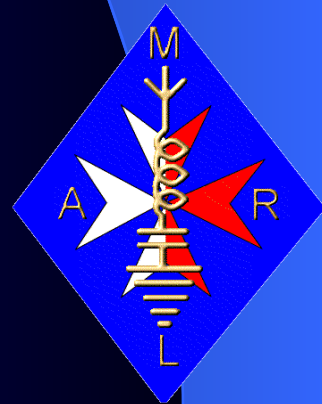
- To receive 10.475GHz the LNB's 9.75GHz LO has to be tuned to 9.4GHz as:

$$10.475\text{GHz} - 9.75\text{GHz} = 725\text{MHz}$$

725MHz is below the range of the receiver

So if the LO is changed to 9.4GHz then:

$$10.475\text{GHz} - 9.4\text{GHz} = 1.075\text{GHz}$$



The Oscillator in the LNB

- The LO is simply a DRO (dielectric resonant oscillator) which works similarly to a normal crystal oscillator but at GHz frequencies!
- It can be tuned down 350MHz by raising it 1mm above the PCB with some super glue and re-tuning with the tuning screw.
- It can be aligned on a satellite signal...such as RAI 1 on the Hotbird Satellite...simple re-tune the DRO until you find RAI 1 350MHz below it's original frequency!





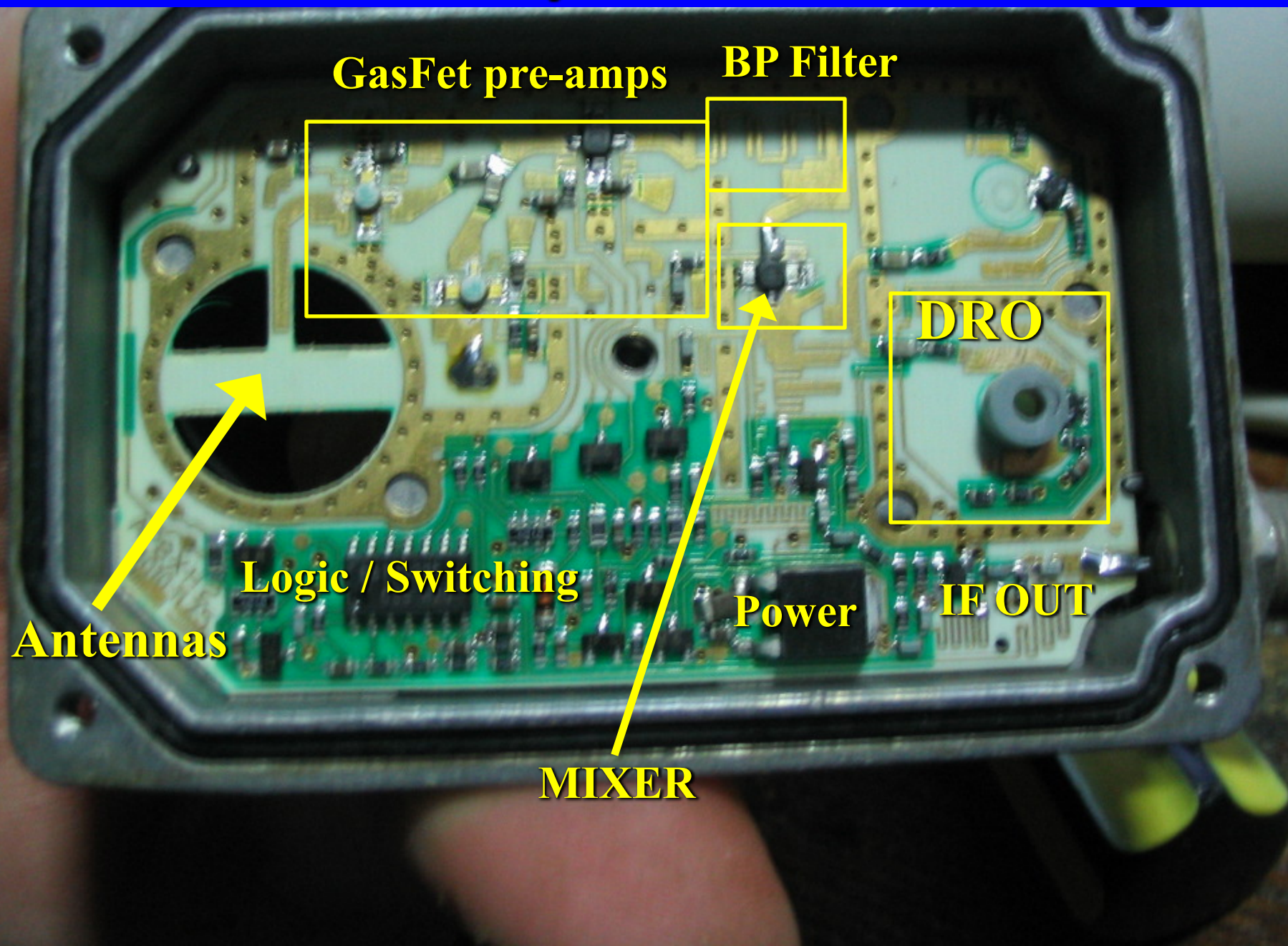
An normal TVRO LNB

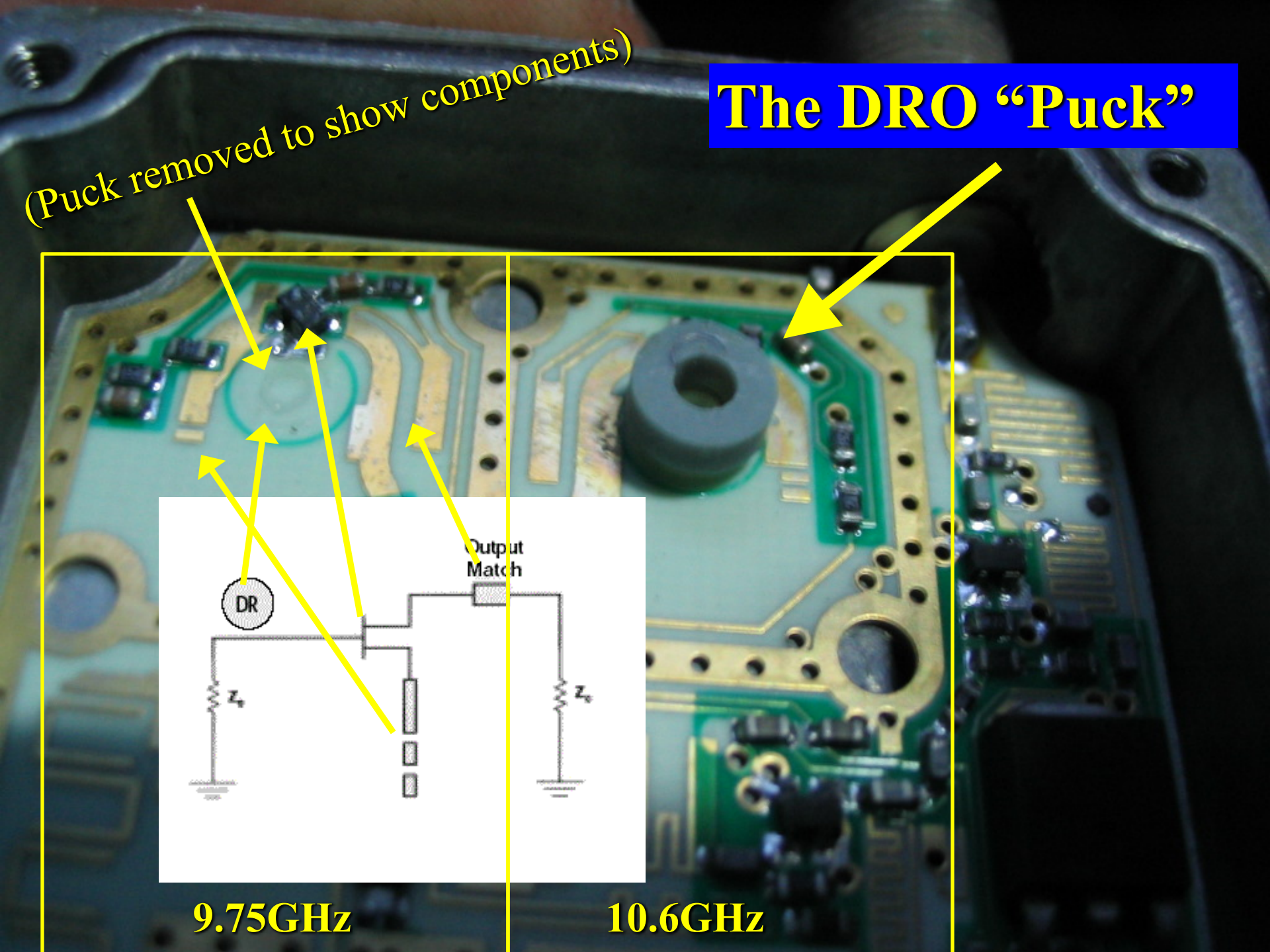


The DRO tuning screws



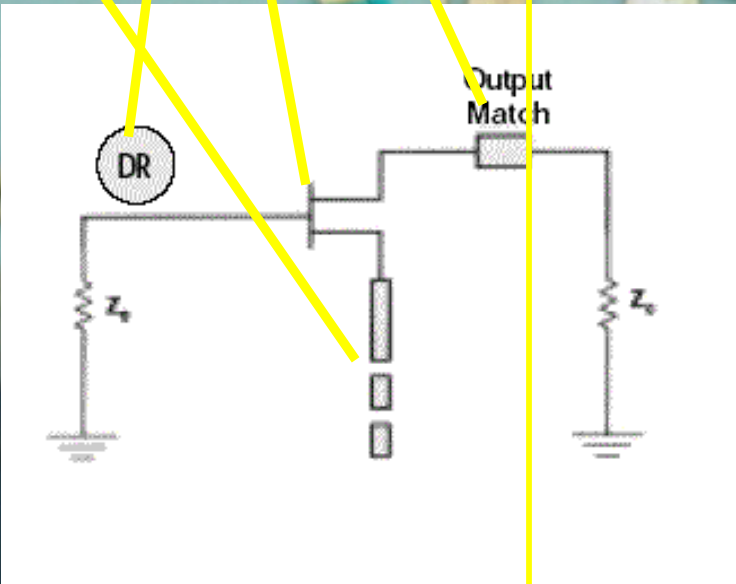
Anatomy of an LNB





(Puck removed to show components)

The DRO "Puck"



9.75GHz

10.6GHz

DRO “Pucks”



Receiving 9H1ATV

- Once the DRO is tuned to 9.4GHz you should be able to receive from 10.3GHz to about 11.7GHz
- Once the LNB is mounted on the dish and pointed at Mdina you should receive 9H1ATV on 10.475GHz
- The IF should be 1.075GHz
 $10.475\text{GHz} - 9.4\text{GHz} = 1.075\text{GHz}$



Receiving 9H1ATV Repeater

